ISSN (print) 0093-4666 © 2014. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/127.51

Volume 127, pp. 51–57 *January–March 2014*

The lily magnolia powdery mildew *Erysiphe magnifica* found in Slovakia

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Abstract — Powdery mildew symptoms were observed on leaves of lily magnolia (*Magnolia liliiflora*) in Slovakia. The causal fungus was identified as *Erysiphe magnifica* based on the morphology of both anamorphic and teleomorphic stages. This is the first report of *E. magnifica* on lily magnolia in Slovakia. A detailed description, illustrations, the host range, and the distribution of this fungus are given.

Key words — *Magnoliaceae*, *Erysiphales*, morphology

Introduction

The genus *Magnolia* L. is represented by around 100 species of deciduous and evergreen trees or shrubs as well as countless cultivars and occurs naturally throughout Asia, North America, and Central and South America (Horáček 2005). According to the last comprehensive survey of *Magnolia* in Slovakia conducted in the early 1980s (Benčať 1982), the most commonly grown species is *Magnolia* ×*soulangeana* Soul.-Bod. (*M. denudata* × *M. liliiflora*), while seven other species — *M. acuminata* (L.) L., *M. denudata* Desr., *M. kobus* DC., *M. liliiflora* Desr., *M. obovata* Thunb., *M. salicifolia* (Siebold & Zucc.) Maxim., and *M. tripetala* (L.) L. — are rare in the country. Recently, these species have become more abundant in Slovakia with plantings introduced to private gardens and parks (Reháčková 2009).

Erysiphe magnifica, a common powdery mildew fungus occurring on *Magnolia* spp. in North America and Asia (Braun 1987), has recently been introduced to Europe. In Europe, this fungus has previously been recorded from Germany and Switzerland (Braun et al. 2009), the Netherlands (Pijpers 2009), Italy (Maspero & Tantardini 2011), United Kingdom (Cook et al. 2011), and Ukraine (Chumak et al. 2012). Wolcan & Murace (2009) also report *E. magnifica* from South America.

Erysiphe magnifica is not included in the checklist of fungi of Slovakia (Lizoň & Bacigálová 1998) nor in the monograph of powdery mildews of Slovakia (Paulech 1995). In 2008, a powdery mildew specimen on magnolia was collected in Slovakia and identified as *E. magnifica* based on the morphological characteristics of its anamorph and teleomorph. We describe and illustrate this collection and compare *E. magnifica* with other powdery mildews on magnolias.

Materials & methods

In 2008, lily magnolia leaves with symptoms of a powdery mildew disease were collected in Beladice village, western Slovakia. Samples were examined under an Olympus SZ61 stereomicroscope and Olympus BX51 compound microscope. Measurements were made in distilled water using oil immersion, without any staining. The observed morphological features were compared to previously published descriptions of the species. The fungus was photographed using a digital camera Olympus E410 and Quick Photo Micro (version 2.2) and Deep Focus 3.1 software. Representative material was deposited in the mycological herbaria of Institute of Forest Ecology of SAS, Nitra, Slovakia (NR) and Institute of Botany of SAS, Bratislava, Slovakia (SAV).

Taxonomy

Erysiphe magnifica (U. Braun) U. Braun & S. Takam., Schlechtendalia 4: 10, 2000.
PLATE 1
≡ *Microsphaera magnifica* U. Braun, Mycotaxon 16(2): 418, 1983.

Mycelium amphigenous, forming irregular white patches or effuse. Hyphae septate, hyaline, irregularly branched. Appressoria solitary or in opposite pairs, nippled-shaped to lobed. Conidiophores erect, 65–114 µm long, arising mostly centrally from top of the hyphal mother cell, foot cells straight, rarely curved at the base, followed by 1–3 shorter cells producing conidia singly, *Pseudoidium* type. Conidia solitary, hyaline, without fibrosin bodies, primary conidia ellipsoid-ovoid, apex rounded, base subtruncate, secondary conidia doliiform, both ends subtruncate, 22–38 × 13–18 µm (l/w = 1.6–2.4); conidial germ tubes subterminal, ending in a lobed appressorium. Chasmothecia scattered, globose, dark brown to blackish, 95–145 µm in diam., peridial cells conspicuous, irregularly polygonal, 10–25(–30) µm wide. Appendages hyaline, pale brownish at the base, aseptate, more or less equatorial, 8–14 in number, straight to curve, 90–142 µm long (i.e., 0.75–1.5 times as long as the chasmothecial diam.), and 7–15 µm broad, apex 4–6 times regularly dichotomously branched, tips of the ultimate branchlets recurved to uncinate. Asci 4–5 per chasmothecium, 59–81 × 40–54 µm, broadly ellipsoid-obovoid, saccate, narrowed towards the base, short stalked or sessile, containing 3–6 ascospores. Ascospores hyaline, ellipsoid-ovoid, 24–34 × 13–22 µm (l/w = 1.4–2.2).

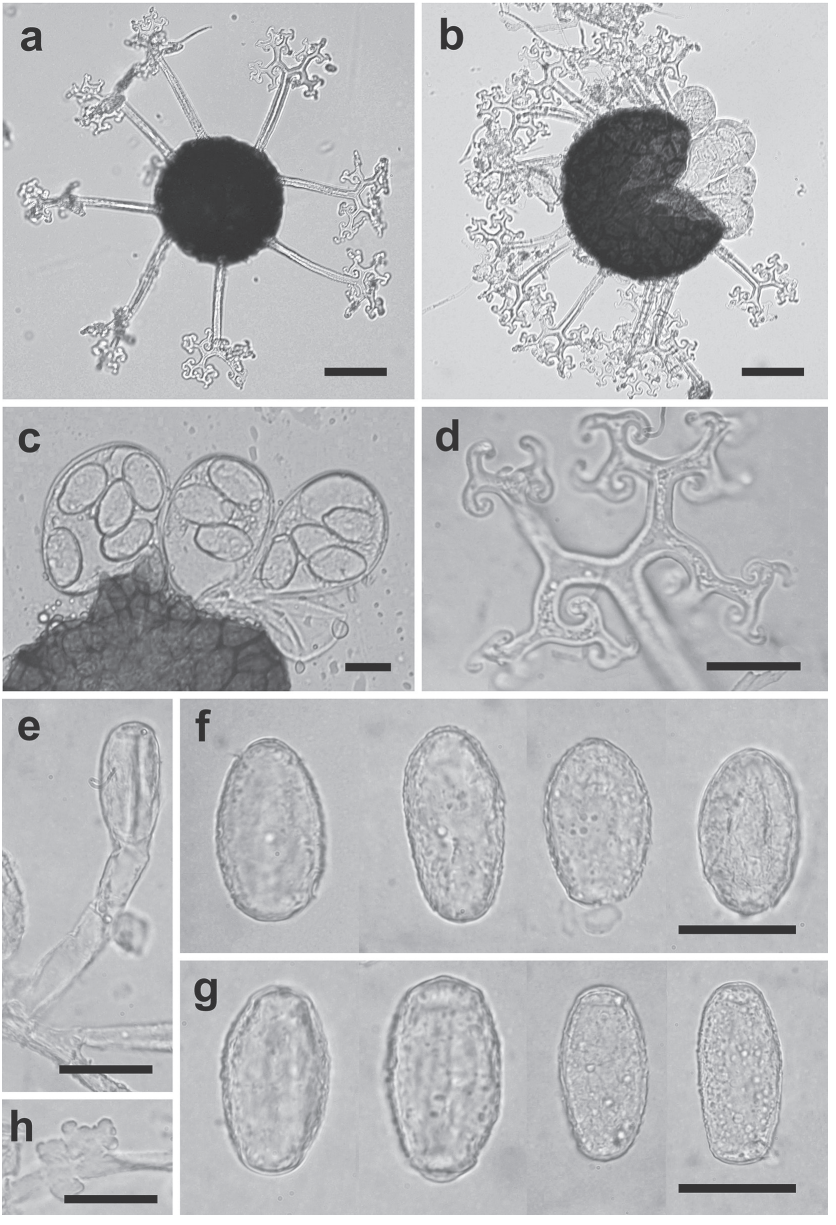

Plate 1. *Erysiphe magnifica* (SAV K1768). a, b: Chasmothecia; c: Asci with ascospores; d: Apex of appendage; e: Conidiophore; f: Primary conidia; g: Secondary conidia; h: Hyphal appressoria. Scale bars: a, b = 50 μm; c–h = 20 μm.

Specimen examined — **SLOVAKIA**. **Nitra**, Zlaté Moravce District, Beladice, Park Hotel Tartuf, on leaves of *Magnolia liliiflora*, 27 Aug. 2008, leg. G. Juhásová (NR 5068, SAV K1768).

Notes — The first conspicuous signs of *M. liliiflora* leaf damage by powdery mildew disease were recorded in the park around Hotel Tartuf in Beladice in late July 2002 (no specimen preserved). Subsequently the disease appeared annually at that site. Upper leaf surfaces were lightly covered by a soft white mycelium. In August 2008 we observed well developed mycelium with mature chasmothecia. The dense grayish white mycelium mostly covered the entire leaf blade surfaces. Almost all leaves of the shrubs were infected, and the heaviest infections were seen at the bottom of the shrubs. Despite the heavy infection, noticeable discoloration of host leaves was not observed.

This is the first record of *E. magnifica* from Slovakia. In Table 1, we compare the diagnostic morphological characteristics of our specimen with published data from German, North American, and Korean collections of *E. magnifica*.

Table 1. Biometric characteristics of *Erysiphe magnifica* on *Magnolia liliiflora* from Slovakia compared with previous descriptions

	Slovakia	Germany (Kirchner 2010)	USA (Glawe 2003)	Korea (Shin 2000)
Chasmothecia diam. (μm)	95–145	96–135(–144)	75–156	88–120
Appendages				
Number	8–14	6–14	Not given	7–13
Length (multiple of chasmothecial diam.)	0.75–1.5	0.7–1.5	Not given	0.8–1.4
Ascus dimensions (μm)	59–81 × 40–54	53–67 × 38–48	47–63 × 40–48	44–60 × 34–42
Ascospores				
Number per ascus	3–6	2–6	3–6	4–6
Dimensions (μm)	24–34 × 13–22	23–33 × 13–15	21–27.5 × 12–17	22–28 × 12–14
Conidiophores Length (μm)	65–114	Not given	Not given	70–120
Conidia Dimensions (μm)	22–38 × 13–18	25–31 × 10–14	24–32.5 × 12–16.5	27–38 × 13–16

Discussion

Five powdery mildew species — *Erysiphe aquilegiae* DC., *E. bulbosa* (U. Braun) U. Braun & S. Takam., *E. magnifica*, *E. magnoliae* (Sawada) U. Braun & S. Takam., *Phyllactinia magnoliae* Y.N. Yu & S.J. Han — have been reported as occurring on *Magnolia* spp. (Braun & Cook 2012), of which three are placed in *Erysiphe* sect. *Microsphaera*: *E. bulbosa*, *E. magnifica*, and *E. magnoliae*.

Erysiphe bulbosa differs from *E. magnifica* by the bulbous base of its chasmothecial appendages, while *E. magnoliae* is distinguished by chasmothecial

appendages that are much longer relative to the chasmothecial diameter and which have straight, pointed, or subclavate tips on their ultimate branchlets. Moreover, *E. magnifica* is the only species of *Erysiphe* sect. *Microsphaera* recorded from Europe on magnolias; *E. bulbosa* and *E. magnoliae* have been recorded only from Asia (Amano 1986, Braun & Cook 2012, Kobayashi 2007).

Table 2 summarises literature records of magnolias hosting *E. magnifica*. These records, from areas with climates ranging from subarctic (USA: Alaska) to humid subtropical (Argentina), demonstrate that *E. magnifica* can live in extremely different environments. *Erysiphe magnifica* has also been recorded from a non-magnoliaceous host, *Nelumbo nucifera* Gaertn. (*Nelumbonaceae*) (Kirschner 2010).

Table 2. Global distribution of *Magnolia* species attacked by *Erysiphe magnifica*

Geographic region		*Magnolia* taxa	References
Asia	Japan	*kobus*, *liliiflora*	Nomura 1997
	Korea	*kobus*, *liliiflora*, *obovata*, *ovata*, *sieboldii*	Shin 2000, Cho & Shin 2004
Europe	Germany	*liliiflora*	Kirschner 2010
	Italy	×*soulangeana*	Maspero & Tantardini 2011
	Netherlands	×*soulangeana*, *stellata*	Pijpers 2009
	Slovakia	*liliiflora*	This paper
	Switzerland	*kobus*, *liliiflora*, *liliiflora* var. *nigra*	Braun et al. 2009
	Ukraine	*acuminata, ashei, kobus, liliiflora,* ×*loebneri, obovata, salicifolia, sieboldii,* ×*soulangeana, sprengeri, stellata, tripetala*	Chumak et al. 2012
	UK	×*soulangeana*	Cook et al. 2011
North America	Canada	×*soulangeana*	Elmhirst 2013
	USA	*acuminata*, *grandiflora*, *liliiflora*, ×*soulangeana*, *stellata*	Braun 1983, 1987; Amano 1986, Saenz & Taylor 1999, Shin 2000, Glawe 2003
South America	Argentina	*liliiflora*	Wolcan & Murace 2009

Old Italian collections of the powdery mildews on *Magnolia pumila* Andrews (= *Magnolia liliifera* (L.) Baill.) have been assigned to *Erysiphe polygoni* DC. (Ciferri & Camera 1962) and *Erysiphe communis* (Wallr.) Schltdl. (Amano 1986). The status of these records is unclear. The identity of a North American record of *Uncinula bivonae* Lév. (nom. illegit., currently regarded as a synonym of *Erysiphe ulmi* Castagne var. *ulmi*) on *M. acuminata* (Amano 1986) is likewise unclear, since material was not available for examination. *Microsphaera penicillata* (Wallr.) Sacc., recorded from the USA on *M. liliiflora* and *M. stellata* (Siebold & Zucc.) Maxim. by Ellett (1966), very probably refers

to *E. magnifica*. Boesewinkel (1979) recorded *Oidium* sp. on *Magnolia* sp. in New Zealand but did not provide a description. McKenzie & Dingley (1996) also recorded only a powdery mildew anamorph of the *Pseudoidium* type (described as *Microsphaera* sp.) on *M. quinquepeta* (Buc'hoz) Dandy in New Zealand. We had no opportunity to examine the above collections to determine whether any represents *M. magnifica*.

According to Braun (1987), *E. magnifica* is morphologically close to *E. ornata* (U. Braun) U. Braun & S. Takam. var. *ornata* on *Betula* (*Betulaceae*) and *E. pseudopusilla* U. Braun & S. Takam. on *Euonymus* (*Celastraceae*), but their host preferences clearly differentiate these three species.

Acknowledgements

We thank Silvia M. Wolcan (National University of La Plata, La Plata, Buenos Aires, Argentina) for information on the recently recorded collections from Argentina, and Martin Pastirčák (Plant Production Research Institute, Piešťany, Slovakia) for photo editing. The authors are also indebted to Uwe Braun (Martin Luther University, Halle, Germany) and Levente Kiss (Hungarian Academy of Sciences, Budapest, Hungary) for critical comments on the manuscript and for acting as peer-reviewers, and to Shaun R. Pennycook (Landcare Research, Auckland, New Zealand) for nomenclatural review. This study was supported by Slovak Research and Development Agency under the contract No. APVV-0421-07.

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